

lent storm in Culion on the 15th and San Jose Mindoro during the night of the 15th and 16th. The steamer *Perlak* was in the center of this typhoon only about 9 miles to the W. of south Mindoro, the barometer having fallen at midnight of the 15th to 28.14 inches (714.75 mm.). We have no observations from midnight to 8 a. m. of the 16th, as the barometer with which the observations were made was lost in the storm. But as it was about or not far from 1 a. m. when the vortical calm was observed, we suppose that the barometric minimum was still lower. During the calm the stars could be seen and many birds fell on the ship.

The small typhoon lost much of its energy on striking Mindoro and filled up within the Philippines on the 17th between 13° and 14° latitude N. and near 123° longitude E.

Besides the Philippine depression and typhoon mentioned another typhoon was shown by our weather maps at 6 a. m. of October 1 to the SE. of Tokio in about

141° 30' longitude E., 33° 35' latitude N., moving ENE. The steamer *President Adams* was near the center with a barometric minimum of 29.03 inches (737.35 mm.) at 5 a. m. of October 1. This was the same typhoon mentioned in our article for last month as situated on the 25th of September between Guam and the Philippines moving WNW. On the 26th it took a northerly direction until it recurved to ENE. on the 30th. The steamer *Radnor* met this typhoon to the east of the Loochoos with a barometric minimum of 29.27 inches (743.44 mm.) at 6 a. m. of September 28.

The approximate positions of the center at 6 a. m. of September 24 to 30 were as follows:

24th, 6 a. m., 142° 10' long. E., 11° 00' lat. N.  
 25th, 6 a. m., 137° 00' long. E., 13° 40' lat. N.  
 26th, 6 a. m., 132° 15' long. E., 15° 45' lat. N.  
 27th, 6 a. m., 130° 50' long. E., 19° 15' lat. N.  
 28th, 6 a. m., 132° 00' long. E., 23° 10' lat. N.  
 29th, 6 a. m., 132° 20' long. E., 27° 50' lat. N.  
 30th, 6 a. m., 133° 40' long. E., 31° 20' lat. N.

## DETAILS OF THE WEATHER IN THE UNITED STATES

### GENERAL CONDITIONS

The current month was the first of 1925 having a temperature considerably below the normal. Three anticyclones, each of more than the usual intensity for October, brought unseasonably low temperature to the upper Missouri Valley and the northern Plains States. These anticyclones were well distributed throughout the month, one each occurring in the first, second, and third decades, respectively. Concomitant features were an increase in the number and intensity of cyclonic storms and fairly abundant rainfall in the Rocky Mountain and Plateau regions, the Gulf and southeastern States. The usual details follow.—A. J. H.

### CYCLONES AND ANTICYCLONES

By W. P. DAY

The number of low-pressure areas during October was decidedly above the normal. The paths of 23 of these have been plotted on Chart II, a number not often exceeded during a winter month. The storm areas at times followed each other in close succession with but slight intervals of rising pressure between.

High-pressure areas were rather less than the normal in number; 11 which could be definitely traced were plotted on Chart I. Of the three important HIGHS, two were well shown at Fort Simpson, Canada, before reaching the United States. The one which appeared in the Northwest on the 18th, however, was not definitely heralded at Fort Simpson.

### FREE-AIR SUMMARY

By L. T. SAMUELS

The large negative temperature departures occurring at certain stations present the most outstanding feature in the average free-air conditions for the month. It is evident from Table 1 that these departures are greatest and of practically equal magnitude at the three northernmost stations, somewhat smaller at Broken Arrow and least at Groesbeck and Due West, the southern and eastern-most stations, being practically negligible at the latter place. At the northern stations they remain exceedingly large to the upper limit of the observations which at Ellendale was 5,000 m., while at Broken Arrow and Groesbeck the usual decrease with altitude occurs. The constancy of the abnormally low temperatures

throughout the month at the northern stations is well brought out in the following table by the high percentages of days (i. e., of those on which kite flights were made) having temperatures below normal.

Station	Surface	Meters above sea level				
		1,000	2,000	3,000	4,000	5,000
Ellendale.....	90	97	97	84	83	100
Drexel.....	96	92	81	69	75	-----
Royal Center.....	90	88	89	83	-----	-----
Broken Arrow.....	67	63	50	50	50	-----
Groesbeck.....	52	58	17	33	33	-----
Due West.....	46	44	33	33	-----	-----

Another feature was the abnormally high winds which prevailed at various altitudes in the latter half of the month during which period two pronounced anticyclones passed over the greater portion of the country. The strong winds were not confined to the regions above these HIGHS, however, but prevailed in general over the intervening LOWS as well. Some of the highest velocities recorded during this period are shown below.

Station	Date	Velocity	Direction	Altitude
		M. p. s.		M.
Broken Arrow.....	19	40		6,000
Denver.....	25	36	WNW.	4,600
Drexel.....	28	41	WNW.	5,800
Due West.....	27	36	WSW.	6,000
Do.....	28	39	WSW.	7,000
Ellendale.....	16	40	W.	8,000
Do.....	31	39	WNW.	6,300

The pronounced anticyclone which prevailed at the end of the month was accompanied by record minimum temperatures for October for various altitudes at all aerological stations. As would be expected with such marked deficiencies in the monthly mean temperatures, the average relative humidities were above normal while the vapor pressures were mostly below.

The resultant winds for the month, in keeping with the large negative temperature departures, show unusually pronounced deviations from their normals. In table 2 it will be noted that the normal resultant at Drexel contains an appreciable south component whereas, a large north component is found for this month. At other stations the south component is considerably less pro-

nounced than normal while the resultant velocities in practically all cases exceed their normals.

Pilot balloon observations indicated a well-defined resultant wind which at 1,000 m. was northwesterly over the northern Plains states, westerly over the Great Lakes and New England and southwesterly over the southern Plains states and generally east of the Mississippi River. At 4,000 m. the south component in the monthly resultants is confined to Groesbeck and Key West, the southernmost stations. At San Juan the resultant for the month continues mostly easterly with an appreciable velocity to 4,000 m. From this altitude to 7,000 m. the resultant velocity is too low to be of significance, but above this to 13,000 m. the resultant direction is westerly and the velocity appreciable. This station obtained during the month nine observations exceeding 10,000 m. in altitude.

Free-air observations were secured at Due West on the 10th in the front sector of a pronounced anticyclone. The accompanying changes in temperature, relative humidity and wind direction from the preceding day are shown in the following table, wherein it is evident that the greatest fall in temperature occurred below an altitude of 1,000 m. A strong inversion on the 10th from  $-3.9^{\circ}\text{C.}$  at 1,800 m. to  $5.3^{\circ}\text{C.}$  at 2,130 m. clearly marks the upper boundary of this anticyclone at this time. The relative humidity was lower at corresponding altitudes on the 10th than on the 9th, the differences increasing with elevation.

Altitude (m.) m. s. l.	Temperature 9th	$\Delta t./100\text{m.}$ 9th	Temperature 10th	$\Delta t./100\text{m.}$ 10th	Direction 9th	Direction 10th	Relative humidity 9th	Relative humidity 10th
217 (surface)---	22.0	---	9.8	---	WSW.	NNE.	77	47
500.....	19.9	0.74	6.3	1.24	W.	N.	80	52
1,000.....	15.7	0.84	1.5	0.96	W.	N.	88	58
1,500.....	11.0	0.94	-2.6	0.82	WNW.	NNW.	99	61
2,000.....	11.0	0.00	1.6	-0.84	WNW.	N.	57	21
2,500.....	8.3	0.54	4.3	-0.54	WNW.	NNW.	66	9

The kite flight of the 5th at Drexel, made in the rear of a rather weak anticyclone, illustrates the large order of magnitude through which the relative humidity in the free air occasionally changes during a very short time interval. During the ascent of this flight the relative humidity reached a minimum of 29 per cent at 3,648 m. From this altitude it increased to 62 per cent at 4,142 m., the maximum height attained. During the descent, however, the instrument-carrying kite encountered a cloud layer the base of which had lowered since the ascent of the kite flight and consequently a relative humidity of 100 per cent was recorded at the same altitude where an hour previous the low value of 29 per cent obtained. Throughout the descent, i. e., below the cloud base to 2,000 m., the relative humidity was considerably higher than during the ascent, the temperature from  $1^{\circ}\text{C.}$  to  $2^{\circ}\text{C.}$  lower, whereas the wind direction remained WSW. The fall in temperature does not account for the rise in relative humidity, since the vapor pressure increased materially during the descent as compared with corresponding altitudes during the ascent. This saturated

condition apparently continued to progressively lower altitudes and showers soon followed with the arrival of a Low from the west.

In an airplane observation at Washington on the 16th the observer noted both on the ascent and descent a shower of rain falling from a layer of A Cu whose base lay above 3,644 m., the maximum altitude of the flight. The shower extended, however, only about 500 m. below the cloud base, the average relative humidity of the intervening air column being low and the mean lapse rate from the ground to the cloud base only  $0.39^{\circ}\text{C.}$  per 100 m. Due to an approaching Low from the southwest the surface wind soon shifted to southerly, which resulted in a steeper lapse rate and a rainfall of 0.19 of an inch during the afternoon and evening of the same day.

TABLE 1.—Free-air temperatures, relative humidities and vapor pressures during October, 1925

TEMPERATURE (° C.)												
Altitude  m. s. l.  (meters)	Broken Arrow, Okla. (233 meters)		Drexel, Nebr. (396 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from 8-yr. mean	Mean	De- parture from 10-yr. mean	Mean	De- parture from 5-yr. mean	Mean	De- parture from 8-yr. mean	Mean	De- parture from 8-yr. mean	Mean	De- parture from 8-yr. mean
Surface..	11.6	-4.8	3.4	-7.6	16.0	+0.1	0.5	-6.6	16.9	-1.7	6.7	-6.5
250.....	11.5	-4.8	.....	.....	15.7	+0.1	.....	.....	16.3	-2.1	6.4	-6.6
500.....	9.9	-5.3	2.8	-7.9	13.6	-0.1	0.3	-6.9	14.8	-2.7	4.3	-7.3
750.....	9.3	-4.9	1.5	-8.4	12.1	-0.3	-0.5	-7.6	14.0	-2.4	2.6	-7.6
1,000.....	8.8	-4.3	1.1	-8.1	11.2	-0.2	-1.7	-8.1	14.1	-1.2	1.2	-7.7
1,250.....	8.4	-3.8	0.7	-7.8	10.1	-0.3	-2.6	-8.2	14.1	-0.3	0.2	-7.5
1,500.....	8.2	-3.1	0.4	-7.3	8.8	-0.6	-3.6	-8.3	13.7	+0.4	-0.4	-7.0
2,000.....	7.1	-2.1	-0.7	-6.2	7.2	-0.4	-5.1	-7.7	12.2	+1.0	-2.8	-7.1
2,500.....	5.4	-1.4	-2.6	-5.5	5.3	-0.7	-6.8	-7.0	9.4	+0.5	-4.7	-6.7
3,000.....	2.9	-1.2	-5.1	-5.3	3.1	-0.7	-8.9	-6.5	6.6	-0.1	-7.5	-7.1
3,500.....	0.4	-0.9	-7.4	-5.0	0.4	-0.7	-11.5	-6.3	4.7	+0.2	-9.3	-6.4
4,000.....	.....	.....	-10.9	-5.9	.....	.....	-14.0	-6.1	1.4	-0.5	.....	.....
4,500.....	-2.2	.....	-14.2	-6.8	.....	.....	-16.1	-5.4	.....	.....	.....	.....
5,000.....	.....	.....	.....	.....	.....	.....	-18.2	-4.9	.....	.....	.....	.....

RELATIVE HUMIDITY (%)												
Surface..	74	+7	73	+11	63	+1	75	+7	80	+6	75	+8
250.....	74	+7			63	+1			80	+8	75	+8
500.....	74	+10	72	+12	64	+2	74	+8	81	+12	77	+12
750.....	72	+9	70	+12	65	+3	71	+10	79	+11	80	+16
1,000.....	67	+6	67	+11	66	+5	71	+12	74	+7	80	+17
1,250.....	63	+4	65	+11	67	+7	70	+13	67	+2	74	+14
1,500.....	60	+3	61	+8	66	+8	68	+14	64	+1	65	+9
2,000.....	55	+4	57	+4	49	-2	60	+10	51	-6	60	+9
2,500.....	51	+5	58	+6	45	+1	55	+7	55	+2	54	+7
3,000.....	51	+8	61	+11	42	0	48	+2	51	+5	61	+16
3,500.....	48	+6	58	+10	41	+1	49	+3	45	+2	55	+12
4,000.....	53	+14	60	+14			49	+5	54	+12		
4,500.....			58	+14			40	-3				
5,000.....							32	-9				

VAPOR PRESSURE (mb.)												
Surface	11.31	-1.43	5.91	-2.54	13.03	+1.31	4.98	-1.92	17.05	+0.69	7.99	-2.44
250	11.24	-1.41			12.84	+1.28			16.42	+0.69	7.87	-2.44
500	10.18	-1.23	5.59	-2.56	11.08	+1.26	4.86	-1.95	14.96	+0.75	7.02	-2.07
750	9.33	-1.09	4.92	-2.51	10.81	+1.20	4.36	-2.00	13.68	+0.52	6.44	-1.72
1,000	8.57	-0.98	4.52	-2.37	10.22	+1.30	3.99	-1.86	12.61	+0.58	5.86	-1.56
1,250	8.05	-0.65	4.27	-2.05	9.36	+1.29	3.69	-1.62	11.19	+0.35	4.99	-1.60
1,500	7.52	-0.33	3.90	-1.93	8.14	+0.99	3.35	-1.42	10.05	+0.37	4.19	-1.58
2,000	5.97	-0.01	3.51	-1.48	5.00	-0.42	2.68	-1.17	6.94	-0.36	3.47	-0.99
2,500	4.58	+0.04	3.08	-0.99	3.74	-0.36	2.13	-1.01	5.78	+0.03	2.71	-0.80
3,000	3.63	+0.14	2.77	-0.47	2.48	-0.84	1.59	-0.94	4.10	-0.20	2.99	+0.10
3,500	2.59	+0.11	2.43	-0.15	1.56	-1.13	1.43	-0.64	2.66	-0.72	2.84	+0.52
4,000	1.89	-0.15	2.03	-0.07			1.28	-0.34	2.58	-0.22		
4,500			1.89	+0.12			1.08	-0.16				
5,000							0.94	-0.02				

TABLE 2.—Free-air resultant winds (m. p. s.) during October, 1925

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters)				Drexel, Nebr. (396 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)			
	Mean		8-year mean		Mean		10-year mean		Mean		5-year mean		Mean		8-year mean		Mean		8-year mean		Mean		8-year mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface.....	N. 37° E	0.8	S. 2° E	2.1	N. 84° W	1.2	S. 25° W	1.4	N. 46° W	0.7	N. 47° E	2.2	N. 40° W	3.4	N. 69° W	1.7	N. 15° W	0.5	S. 74° E	0.7	S. 71° W	2.8	S. 49° W	2.3
250.....	N. 36° E	0.8	S. 5° E	2.3	N. 84° W	1.2	S. 25° W	1.4	N. 46° W	0.7	N. 47° E	2.2	N. 40° W	3.4	N. 69° W	1.7	N. 15° W	0.5	S. 74° E	0.7	S. 71° W	2.8	S. 49° W	2.3
500.....	S. 67° E	0.8	S. 5° E	2.3	N. 84° W	1.2	S. 25° W	1.4	N. 46° W	0.7	N. 47° E	2.2	N. 40° W	3.4	N. 69° W	1.7	N. 15° W	0.5	S. 74° E	0.7	S. 71° W	2.8	S. 49° W	2.3
750.....	S. 50° W	1.8	S. 12° W	4.1	N. 66° W	3.5	S. 42° W	3.5	S. 73° W	2.8	N. 58° E	2.8	N. 50° W	4.2	N. 88° W	2.7	S. 27° W	1.3	S. 14° E	2.8	S. 63° W	6.5	S. 62° W	5.8
1,000.....	S. 61° W	2.3	S. 21° W	4.1	N. 55° W	4.4	S. 51° W	3.9	S. 81° W	4.1	N. 54° E	1.9	N. 53° W	5.4	N. 88° W	3.2	S. 33° W	2.1	S. 4° E	2.8	S. 70° W	6.6	S. 68° W	6.3
1,250.....	S. 65° W	3.1	S. 35° W	4.2	N. 54° W	4.7	S. 61° W	4.5	N. 87° W	6.3	N. 33° E	1.1	N. 43° W	6.0	N. 84° W	3.9	S. 37° W	3.2	S. 5° W	2.9	S. 83° W	9.1	S. 74° W	7.2
1,500.....	S. 63° W	5.2	S. 42° W	4.5	N. 56° W	5.9	S. 67° W	5.2	N. 87° W	7.6	N. 33° E	0.7	N. 46° W	6.5	N. 85° W	4.6	S. 48° W	4.0	S. 20° W	2.8	S. 85° W	9.5	S. 78° W	8.0
2,000.....	S. 74° W	6.5	S. 52° W	4.8	N. 68° W	8.6	S. 75° W	7.0	N. 74° W	5.5	N. 39° W	1.2	N. 52° W	7.9	N. 82° W	6.2	S. 61° W	5.5	S. 43° W	2.8	S. 89° W	10.6	S. 81° W	9.1
2,500.....	N. 82° W	8.0	S. 65° W	5.2	N. 68° W	10.2	S. 80° W	8.2	N. 77° W	11.6	N. 75° W	3.9	N. 47° W	9.8	N. 79° W	7.7	S. 52° W	7.1	S. 53° W	3.2	S. 88° W	12.8	S. 85° W	10.1
3,000.....	N. 84° W	9.0	S. 70° W	6.4	N. 74° W	13.1	S. 84° W	9.7	N. 86° W	13.3	N. 86° W	5.0	N. 55° W	11.2	N. 81° W	9.0	S. 54° W	9.2	S. 56° W	3.8	N. 84° W	15.2	S. 88° W	11.0
3,500.....	N. 73° W	11.1	S. 73° W	7.5	N. 79° W	13.9	S. 89° W	10.5	N. 85° W	14.3	N. 83° W	6.8	N. 57° W	13.4	N. 82° W	10.9	S. 65° W	10.1	S. 51° W	4.2	N. 68° W	16.2	S. 85° W	13.0
4,000.....	N. 78° W	14.0	S. 68° W	8.6	N. 85° W	16.0	S. 86° W	11.6	N. 85° W	14.3	N. 83° W	6.8	N. 56° W	14.1	N. 86° W	11.4	S. 43° W	12.3	S. 46° W	4.0	N. 68° W	16.2	S. 85° W	13.0
4,500.....	N. 78° W	14.0	S. 68° W	8.6	N. 85° W	16.0	S. 86° W	11.6	N. 85° W	14.3	N. 83° W	6.8	N. 56° W	14.1	N. 86° W	11.4	S. 43° W	12.3	S. 46° W	4.0	N. 68° W	16.2	S. 85° W	13.0

TABLE 3.—Mean free-air temperatures, relative humidities, vapor pressures, and resultant winds during October, 1925, at Washington, D. C.

Altitude m. s. l. (meters)	Naval Air Station (7 meters)			Weather Bureau (34 meters)	
	Temperature (° C.)	Relative humidity (per cent)	Vapor pressure (mh)	Wind	
				Direction	Velocity (m. p. s.)
Surface.....	10.1	77	10.03	N. 65° W.	1.7
150.....	9.4	72	9.03	N. 41° W.	2.8
100.....	8.8	68	8.21	N. 50° W.	4.2
250.....	7.4	68	7.44	N. 65° W.	5.4
5,000.....	6.0	69	6.91	N. 65° W.	6.4
7,250.....	4.7	71	6.48	N. 65° W.	8.2
1,500.....	3.4	71	5.93	N. 65° W.	10.9
2,000.....	1.2	75	4.84	N. 83° W.	13.5
2,500.....	0.5	63	3.09	N. 82° W.	17.5
3,000.....	-0.8	54	2.78	N. 75° W.	20.5
3,500.....	-2.8	60	2.92	N. 79° W.	

## THE WEATHER ELEMENTS

By P. C. DAY, In Charge of Division

## PRESSURE AND WINDS

Unlike the preceding month, October had rapid and important pressure variations, and the weather on the whole had a decided winter aspect from the Rocky Mountains eastward, with record-breaking low temperatures over wide areas, frequent rains in the central and eastern districts, some unusually heavy snows for the season, much cloudy weather and a large deficiency in sunshine.

Cyclonic areas during the first half of the month originated mostly in the Southwest, were mainly ill-defined, but frequently were attended by widely distributed precipitation.

During the latter half cyclonic activity shifted to more northern districts and most storms entered the United States from the Canadian Northwest, frequently well east of their usual course and at times followed each other in rapid succession.

No cyclones appear to have entered the United States via the North Pacific States, a condition rarely existing in October.

While precipitation was frequent in most districts from the Rocky Mountains eastward, it was particularly so in the middle Mississippi and Ohio Valley States and thence eastward, where locally the number of days with rain or snow was the greatest ever observed in October. To the north, precipitation was also frequent, but mostly light, while over the cotton-growing States it was both frequent and locally heavy.

Over the Southern States it was usually associated with the general low-pressure conditions existing in that region near the middle of the month and again about the middle of the last decade.

West of the Rocky Mountains cyclonic activity was at a low ebb due to anticyclonic conditions off the Pacific coast, and there was generally little precipitation over the northern districts, but over southern California and near-by portions of Arizona some unusually heavy rains occurred about the 3d to 6th, and important falls were reported from many parts of the plateau and Pacific coast sections from the 9th to 15th.

Anticyclones persisted to a considerable degree over the upper Missouri Valley and northern Rocky Mountain region, and several of unusual intensity for so early in the cool season moved southeastward into the central and eastern districts. The first, bringing important changes in temperature and interruption to the prevalent rainy conditions, was central over the middle Missouri Valley on the morning of the 9th and moved rapidly to the south Atlantic coast by the 11th, attended by decided falls in temperature, the first killing frosts of the season over extensive portions of the interior, and light frosts in some northern portions of the cotton-growing States.

Another extensive anticyclone entered the upper Missouri Valley on the morning of the 18th and it too moved southeastward, reaching the Gulf coast by the 20th. This likewise was attended by sharp falls in temperature, while frosts occurred somewhat farther south than in the preceding case.

The most important anticyclone, however, entered the northern Rocky Mountain region on the morning of the 27th and gradually overspread the entire country from the Rocky Mountains eastward during the closing days of the month. During its eastward progress the lowest temperatures ever observed in October occurred over large areas from the middle and northern plains eastward to the Ohio Valley and portions of the Northeastern States, and freezing temperatures extended to the middle portions of the Gulf States.

The average pressures were highest over the northern Great Plains and they were generally above normal from the far Northwest eastward to the upper Lakes and generally over the middle and southern plains. Over most districts from the Great Lakes, Ohio and lower Mississippi Valleys eastward the average pressures were mainly below normal, the deficiencies increasing toward the Canadian Maritime Provinces. Over the greater part of the plateau and Pacific Coast States the average pressures were below normal.